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A C C O U N T

Of the M E T H O D S used to describe

L I N E S,

O N

Dr. H A L L E Y's Chart

O F T H E

T E R R A Q U E O U S G L O B E ;

S H E W I N G T H E

Variation of the Magnetic N E E D L E

About the Year 1756,

In all the known S E A S ;

Their Application and Use in correcting the
Longitude at S E A ; with some Occasional
O B S E R V A T I O N S relating thereto,

By WILLIAM MOUNTAINE, and JAMES DODSON,
Fellows of the *Royal Society*.

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THE ASSOCIATED

Variation of the Magnetic Needle

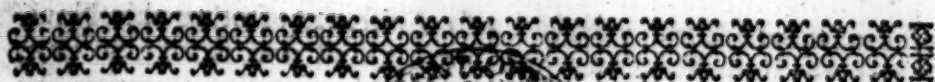
In all the known Seas;

Their Application and Use in conducting the
Longitude as well as some Occasional
Observations.



By WILLIAM MASON and JAMES DODSON
Printed and Sold by the Authors at the





A C C O U N T, &c.



THE first Discoverers of the Polarity of the magnetic Needle, conceived, that the Direction thereof was at all Times, and in all Places, due North; therefore the Navigators of that Date, employed the Discovery in determining the Ship's Course; for since they had from the Compass a visible Meridian, they could Measure the Angle, which the apparent Path of the Vessel made therewith.

But Experience afterwards shewed, that this Polarity was not exact, the Needle in some Places pointing to the Eastward, and in others to the Westward of the true North: This Deflection from the Meridian is usually called the Variation of the Needle or Compass, and was then supposed to be at all Times the same, in the same Place.

Here also the insufficiency of their magnetic Knowledge was soon discovered; for scarce Fifty Years had past before it appeared, that Difference of Time had altered the Variation in the same Place.

Since therefore the Mariner's Compass will not give the Ship's Course truly, unless the Variation at that Time and Place be known, it has been found necessary to make, and preserve Observations of the Variation at different Times and Places, for the Service of the Navigator.

The most valuable and extensive Work of this kind, that made its first Appearance, was Dr. HALLEY's *Chart of the World*; In which, on the *Atlantic* and *Indian* Oceans, he has described Lines, to shew the Quantity of the Variation, in the different Parts of those Seas, at or about the Time of Construction, viz. the Year 1700.

Previous to this Undertaking, the Doctor made a Voyage to the Southward, and had observed the Variation in several Parts

of the *Atlantic* Ocean; he had also Assistance of other able Navigators for those Seas, in which himself had not failed: So that, from these Materials, together with his peculiar Sagacity, he was enabled to exhibit the Variation, in many Places beside those for which he had Observations.

But as the Quantity of the Variation is in a perpetual State of Fluctuation, in almost every Part of the World, we found it so much changed in the space of about Forty Years, that those Curves laid down by Dr. HALLEY were grown intirely useles; and that a System of such Lines, or something Analogous thereto, should be performed once in every ten or twelve Years, at least, in order to answer the Purposes intended.

In the Year 1744, We therefore set about this Performance, by collecting, in the first Place, a great Number of Observations; esteeming this, as the most expedient Method (by concurrent Testimony) to prove the Validity of those, on which the Construction should be founded; in obtaining which, we received the Assistance of the Commissioners of the *Navy*, and of the Directors of the *East-India* and *African* Companies, having leave to peruse the Journals of those Mariners, who were under the Direction of each respective Body: From which, and a few private Communications, we were enabled to accomplish our Design.

This Chart was published in the Year 1745, and notwithstanding we have had the Satisfaction to receive several Accounts and Testimonials of its Accuracy and Service, from Gentlemen who impartially made Use of it, in different Parts of the Ocean; yet it has never returned the first Charge and Expence, which we attribute solely to this Cause, viz. that it has not been sufficiently, and more publickly known to the World. — However this has not discouraged Us from making a second Attempt, for the public Service, as we find the Variation so much altered since the last Publication, that a periodic Review is become absolutely necessary.

The Proprietors of Dr. HALLEY's Chart had (sometime before we engaged in the Undertaking) employed Mr. *Leadbetter*, who attempted to have performed *This*, only from a Sett of Observations, in Number about 1100, made by Mr. *Robert Douglas*, in divers Voyages, wherein he acted as a Teacher of Navigation
on

on Board His Majesty's Ships; his Method seems to have been this;

Since the Variation in 1700, according to Dr. HALLEY, was about 10 deg. 15 min. West at the *Cape of good Hope*, and in the Year 1721, or thereabouts, according to Mr. Douglas, 14 deg. 25 min. West, and since there was some Reason to believe, that in the space of 21 Years, from 1721 to 1742, the like Progressive Motion had continued; therefore he concluded, that in the Year 1742, the Variation at the *Cape of Good Hope* was 18 deg. 35 min. West.

Altho' we were unwilling to trust an Affair of such Importance to a meer Probability, were far from disregarding the Hint: From the great Quantity of Materials in our Possession, we doubted not of being able to draw Lines representing the Variation at the four different Periods of 1711, 1722, 1733, and 1744. and thence by Comparison to have performed the same for 1755; which if it could have been executed, would have prolonged the Use of these Undertakings considerably.

But the impracticability of this Scheme, will readily appear to those who will give themselves the trouble to examine the Situation of the Variation Lines in Dr. HALLEY's *Chart*, and those laid down for the Year 1744, as also those in the present, in and near the Bay of *Bengal*: All that is necessary to be said concerning them, is to assure the Public, that no *Lines* on the *Chart* are described on better Evidence than *those*; and that the Delineations for the Periods before mentioned, altho' they in a great measure contribute to confirm the last, yet would not have given any thing near Information sufficient, to have formed such kind of Lines as now appear, without Observations made about the respective times of Construction; The same may be said at, and near about the Island of *Jamaica*, where the Variation seems to have been almost Stationary for 56 Years last past.

Experience having thus pointed out to us the irregular mutation of the Variation, any Expectations before retained, of re-constructing a Set of Lines by Analogy, now vanished, and we have been obliged to pursue our former tedious, but more safe and justifiable Method of proceeding, which was by collecting the greatest Number of Observations possible.

For

For which purpose,

The Honourable the Commissioners of the *NAVY*, obliged us with with an Order of free Access to all their Masters Log-Books and Journals.

The Directors of the Honourable the *East-India* Company, indulged us with the like Privilege.

The Committee of the Honourable *Hudson's-Bay* Company, gave us a Sett of Observations made in the Tracks of their Trade, and tabulated by some of their Captains.

Dr. *James Bradley*, Regius Professor of Astronomy, and *F.R.S.* favoured us with several Observations made at the Royal Observatory at *Greenwich*.

John Hyde, Esq; *F.R.S.* Communicated a Sett of useful Observations, extracted from two Journals, kept on board the *Triton* and *Britannia East-Indiamen*.

A Correct Journal kept on board the *Delaware East-Indiaman*, was handed to us by a Gentleman unknown.

Capt. *George Snow*, furnished a considerable Number of Observations, made with great Care and Accuracy by himself, in several successive Voyages to, and from *Barbadoes* and *Virginia*, together with several Remarks upon the Subject.

Mr. *Mungo Murray*, Author of a Treatise on Ship-Building, presented us with several Observations taken on Board the *Prince Edward* and *Chesterfield Indiamen*, and His Majesty's Ship the *Neptune*.

All which Assistance is gratefully acknowledged.

Among the Journals which we examined, it was found,

That some contained no Observations of the Variations.

That in some wherein such Observations were found, no Account of Difference of Longitude was kept.

That few contained Observations made near at Home (as supposing the Variation there generally known) in any Harbour, or even within sight of Land.

That, where an Account of the Difference of Longitude was kept, several Instances have been observed in Journals of identical Voyages, wherein the Ship's Place, at the same Time, has been differently determined; And, Some

Some Journals kept on Board Ships in the same Fleet, have differed more considerably.

Observations, therefore, of the Variation, made under any of the above Disadvantages (however serviceable they might have been) were rejected; a considerable Number occurring, which were made by those, whose Accounts were as correct as the Practice of Navigation will permit.

But the Difference of Longitude made between two Ports, by different Ships, or by the same Ship in different Voyages, frequently disagreed with each other, and with the *Chart*.

Therefore in order to apply Observations made under such Circumstances, we were obliged to reduce the Difference of Longitude by Account, to the Standard of the *Chart*; for Instance, let us suppose a Ship's Journal makes the Difference of Longitude from the West-end of *Madeira* to *Barbadoes*, to be 44 deg. 44 min. and that according to the *Chart*, it is but 40 deg. 40 min. since it cannot be granted, that the Error of 4 deg. 4 min. can arise at once; 'twill therefore be more rational to suppose it diffused thro' the whole Voyage; and then to rectify it, there must be a Decrease of one Degree in eleven; now if an Observation of the Variation was made, when according to Account, the Ship had made 30 deg. 48 min. Difference of Longitude from *Madeira*; if the eleventh Part thereof, (*viz.* 2 deg. 48 min.) be taken therefrom, the Remainder (28 deg. 0 min.) will be the Difference of Longitude from *Madeira* according to the *Chart*; and if thereto (18 deg. 0 min.) the Difference of Longitude between *London* and the West-end of *Madeira* be added, the Sum (46 deg. 0 min.) will be the Longitude of the Place of Observation, according to the Graduation of the *Chart*.

But as the Longitude of the *Chart* is graduated only at the Equator, and the Latitude but in two Places, and those 230 deg. 0 min. from each other, we were obliged to make Use of an Instrument to apply those Graduations, in order to fix the Place of Observation expeditiously.

At the four Corners of a Rectangular Plane Table, just big enough to contain sixty Degrees of Longitude, and as many of Latitude, were placed four flat-headed Screws, to keep a Piece of the *Chart* of that Magnitude secure in its Place; on the Frame of this Table, the Degrees of Latitude from 0 deg. to 60 deg. were

were graduated and bisected; and on a T Ruler also those of Longitude; now if the Edge of the Ruler be applied, so as to pass over the Latitude of the Place of Observation on the Frame, and a protracting Pin be moved along it to the Longitude, and there stuck into the Table, it points out the Place of Observation on the *Chart*; which Place was marked with Figures, expressing the Number of Degrees of Variation there observed.

A great Number of Observations made near the same Time, being thus transferr'd to the *Chart*, enabled us to approve of some and reject others, according as they were supported or not, by concurrent Testimony; and thence to draw Lines representing the Variation at that Time.

There are indeed some Lines described on the *Chart*, that have not so great a Confirmation as that above-mentioned; but these Lines are distinguished from the others, by being dotted, or having frequent Breaks in them.

This *Chart*, upon which the Variation Curves are described, is Projected upon Mr. *Wright's* Principles, and consequently whatever Problems are usually solved upon the said *Chart* (commonly called *Mercator's*) adapted for that business alone, may be performed also upon this, with equal Facility, except the Determination of the Course, or Bearing of one Place from another, the Rhumb Lines not being laid down, as is usual in others for that purpose, on Account of the Confusion that would arise by *these* intersecting the Variation Curves; but any Course or Bearing may be easily estimated, by measuring the Angle upon a Line of Chords, which the Scale (laid upon the two Places) makes with any Meridian crossing the same; And how to solve those usual Problems, is directed in most Books treating of Navigation, and which every Artist is acquainted with; shall therefore take no further Notice of them in this place.

But as the Use and Application of the Variation Lines, may not readily occur to every Person into whose Hands they may fall, it may not be amiss to Exhibit a few Examples, for the better Illustration.

Problem 1. The Latitude and Longitude of a Ship at Sea given; required the Variation of the Compass?

Rule,

Rule. Find the Place of the Ship on the *Chart*.

Observe what Curve runs thro' that Place, or nearest thereunto.

Trace this Curve, to the nearest Numerical Index, gives the Variation.

Example 1. At Sea in Latitude 10 deg. North, Longitude 30 deg. West, what is the Variation?

Lay off the Place of the Ship, which will be found by the intersection of the Meridian and Parallel to be at X, trace the Curve passing over that Point, to the Numerical Index, and it directs to three Degrees of Variation West.

Example 2. A Ship is found to be in Latitude 35 deg. 0 min. South, Longitude 7 deg. 00 min. East, what Variation must be allowed in that Place?

The Ship will be found at the Point Z, nearly in the middle between two Curves, trace them down to the lower Index, gives $13 \frac{1}{2}$ deg. West Variation.

But the Utility of these Curves is not confin'd to this single Problem alone; For, in the Southern Parts of the great *Atlantic* Ocean, beginning with the Coast of *Brazil* and *Patagonia*, and proceeding to the South of the *Cape of Good Hope* into the *Indian* Ocean, as far as the common Tracks of our *East-India* Shipse xtend, the Variation Lines have appeared to be, for the most part, directed Northward and Southward; whence in most Places of that great Body of Waters, if the Latitude and Variation be found by Cælestial Observations, the Longitude will be obtain'd by the Lines on the *Chart*; the great usefulness of which has been attested to us, by many Persons who have successfully to themselves, practically apply'd our last constructed *Chart*, to Correct their Dead-Reckoning on that long Passage.

Problem 2. The Latitude and Variation given; to find the Longitude by the *Chart*?

Rule. Draw a Parallel of Latitude, or lay a Scale on the *Chart*, through the Latitude found by Observation.

That Point, where the Curve, whose Variation is the same with that observed, intersects the said Parallel of Latitude or Scale, will be the true Place of the Ship.

Example 1. A Ship by good Observation, is in Latitude 10 deg. 0 min. North; the Variation of the Compass is found to be 3 deg. West; required the Ship's Place? Draw

Draw a Parallel, or lay a Scale over the Latitude of 10 deg. North; where either of these cuts the Curve of 3 deg. Variation, as at X, that will be the Ship's Place, whose Longitude is found to be 30 deg. West from *London*.

Or thus,

Take from the graduated Meridian, the distance between the Equator and the Latitude of 10 deg. North, lay a Ruler along the Equator, and slide one Point of the Compasses along its Edge, 'till the other Point cuts the Curve of 3 deg. Variation, which Point of Intersection gives the Ship's Place as before, at X.

Example 2. At Sea, the Variation was found to be $13\frac{1}{2}$ deg. in the Latitude of 35 deg. South; What Longitude is the Ship in?

Proceed as above directed, and you will find the Place of the Ship at Z, in 7 deg. 00 min. East Longitude, from *London*.

It has frequently been observed, that our former *Chart* has stood condemned, because the Variations found thereby, did not agree with *these* determined by Cælestial Observations; which by no means can happen, if the Curves are justly constructed, but only when the Dead-Reckoning Longitude is true: Hence arises the greatest Advantage possible from the *Chart*, viz. The means of correcting the Longitude, when the Curves run nearly North and South, as above-mentioned.

But where the Variation Lines run nearly East and West, as in the *Atlantic Ocean*, from the West Coast of *Europe*, to the East Coast of *North America*, no Assistance towards obtaining the Longitude can be derived from them; but as it frequently happens within those Limits, that Meridian Observations for determining the Latitude, cannot be obtained, especially about *Newfoundland*; if then a good Observation of the Variation can be taken at any Time of the Day, the Latitude will be nearly ascertained, by the East and West Curve answering thereto on the *Chart*.

Don Antoine De Ulloa, Lieutenant to the Commissaries of the Marine, one of the Gentlemen appointed by the King of *Spain*, to accompany the Academicians of *France*, in the Year 1734, in a Voyage to *Peru*, to measure the Length of a Degree in that Kingdom, near the Equator, embarked on board the *Incendie*, a Fifty Gun Frigate: During the Course of the said Voyage, this ingenious Mathematician has, among other Remarks and Accounts, taken

taken particular Notice of the Variation of the Magnetic Needle, and tabulated his Observations thereupon, together with *Don George Juan's*, another eminent Mathematician and Associate in this Expedition: Both these he has arranged and compared with Variations extracted from our former *Chart*, of similar Latitude and Longitude; all which agree to his Satisfaction, as appears by his own particular Account thereof, given in *Tom. 1st, page 14 &c.* of his Book published at *Paris*, in the Year 1752: But had he made some adequate Allowance for the Mutation of the Variation, between the Years 1735, and the date of our *Chart*, (which we presume he has not) it seems evident from his own Tables, that they would have been much more concurrent.

This Gentleman further recites the excellency and use of these Variation *Charts* in the Practice of Navigation, and strongly recommends to the Mariners, that due Attention be given in the choice of their Compasses, and not only that they be well executed, but also that they be tried and approved upon a Meridian Line, by Persons of Knowledge and Judgment.

In Page 18, he has the following Passage, *viz.* “ Il y encore
 “ dans la Navigation une erreur, à quoi les Pilotes sont fort Sujets,
 “ quolque moins par leur propre faute: c'est de gouverner
 “ de Vaisseau par une Aiguille, et d'observer la Variation par une
 “ autre, &c. which may be translated into *English*, as here followeth, *viz.*

“ There is yet again another Error in Navigation, to which the
 “ Mariners are extreamly subject, altho' it be not quite so much
 “ their own fault; and that is, to steer the Ship by one Compass,
 “ and observe the Variation by another; For altho' they
 “ have been compared, and due Notice taken wherein they
 “ differ, as their Motions are not alike, were there only at the
 “ beginning of a Voyage a few Degrees of difference between
 “ them, the Motion which the former makes continually upon
 “ the Pivot, renders it more inactive than the other, which is only
 “ made use of for Observations, and at all other Times preserved
 “ with care; Hence it comes to pass, that there remains a difference
 “ in the Alterations. To rectify which, it would be necessary
 “ that all Compasses intended for Sea-Service, should also
 “ be equally fitted for Observations of the Variation, and that

“ these Observations should be made with the same Needle or
 “ Compass, by which the Ship's Course is directed ; And in or-
 “ der to have the full Advantage of the Variation *Charts*, it
 “ would be highly necessary that the Needles should all be
 “ touched by one and the same Manner and Method, and ad-
 “ justed to the Meridian of the Place precisely, with the Varia-
 “ tion which is there known to be strictly true. If this Method
 “ was taken, one would not find so much difference between the
 “ Observations made in one Ship, and those made in another,
 “ in the same Place, when the Interval of Time between the
 “ two Observations, is not considerable enough to make a sen-
 “ sible difference between the Variations observed for several
 “ Years past, and admitted by all Nations. ”

It is certainly a matter of great Importance to be furnished with good Needles or Compasses, without which all other Methods will but little avail, and yet this very material Object of Consideration, has been egregiously neglected, until of late Years, when the Judicious Dr. *Gowen Knight*, F.R.S. examined into their Fabric and Construction, employ'd his Magnetic Knowledge towards their Improvement, and has now reduced them to a considerable degree of Perfection, as Experience has sufficiently evinced, more especially since they have been approved of by the *Commissioners* of the Navy, and ordered into Use on Board all His Majesties Ships of War : These Compasses are not only fitted for Steering, but also for taking the Sun's Amplitude and Azimuth, by adding an easy and simple Apparatus for those purposes ; and are made by *George Adams*, Mathematical Instrument-Maker to his Royal Highness the *Prince of Wales*, and before they pass out of his Hands, are examined and attested by the said Doctor *Knight*, whose Certificate is fixed to the Cover of the Box ; without which they are not to be depended on.

Here then we have not only the Machine, but the Method prescribed, and so much desired by *Don Antoine De Ulloa*, and that at a much less Price than the *Old Azimuth Compasses* alone used to be Sold for ; as therefore it is the Interest, so, without doubt, it will be the Inclination of every Mariner to give some Attention and Encouragement to so great an Improvement.

In making Observations, due regard should be had to the Sta-
 tion



tion appointed for that purpose, that it may be as free as possible from the particular Attraction of contiguous Guns, Stantions or other Iron-Work ; and as this may be attended with some difficulty, the best Method we can at present think of, is to compare the Compass intended for the Observation, not only with that used in the Binnacle, but also with itself, by Observations made in different Stations ; for if such Attraction should take place, and proper Allowance not made for the same, the Correction of the Courses will be erroneous, as well as the determination of the Longitude, if it happen among the Meridional Curves.

In order therefore to render these *Charts* as Accurate, and consequently as useful as possible, in the Practice of Navigation, it is greatly to be wished, that the learned and ingenious Inhabitants of every part of the Earth, would periodically observe the Variation of the Needle at those Places where they reside, or through which they travel ; because their Observations made on Shore, will be less liable to Error than those made at Sea ; and because those Observations communicated to the Persons, who may hereafter undertake a Work of this Kind, (as Time must render it necessary) will enable them, not only to be more certain of the Lines they are to draw over the Oceans ; but also to describe the like over the Land, which would render them compleat.

There are two powerful Inducements to bestow a little Time and Pains thereon, *viz.* 1st, That it will be productive of general Service ; and 2^{dly}, That it would certainly be of some Reputation to those who assist in so good a Work, although they (being no ways concern'd in Maritime Affairs, which is a case that cannot happen to many) should reap no other Benefit therefrom.

But as to the Mariners, whose Credit with their Employers, depends on an Opinion of their Skill and Fidelity ; whose Subsistence and further Hopes of making a Fortune in the World, depend on the Success of their present and future Voyages ; nay, whose very Lives depend on their Judgment and Care ; it cannot be supposed that they will need any Spur to incite them to do all in their Power, in order to render those valuable Blessings (Reputation, Estate and Life) more Secure : It may therefore be sufficient to mention a Method (presumed to be) partly practiced by some, and it is hoped, not unworthy the Notice of all.

As there are several Persons in every considerable Ship, who are expected to keep Journals; suppose so many of them as can be spared from necessary Business, be summoned by the Commander once a Day, and required to give an Account of the Place of the Ship, at the last Noon; when should it happen (as it has been before observed) that any two or more of them disagree therein, let their Quotations from the Log-Board, their Allowance for Variation, Leeway, Currents, Swells, Indraughts, &c. may even their Computations be compared; and from that Comparison, by Agreement of Persons appointed, let such a Latitude and Longitude, as shall seem most reasonable, be fixed for the Ship's Place at that Time, and entered in a Book kept for that purpose, (which might be called, not the Captains, Lieutenants, &c. but the Ships Journal,) with the Particulars of all the Allowances made in the Calculation thereof, and the most material Occurrences; especially Observations of the Variation, made as often as may be, particularly near or upon the Shore; of the Latitudes, and Longitudes of Places, made also on Shore; and of the direction and velocity of Currents, &c.

When a Ship comes into Port, let the Difference of Longitude between the Place sailed from, and the Port arrived at, according to every particular Man's Account, as well as by the Ship's Journal, be entered therein.

Where several Ships sail together, suppose the Admiral or Commodore, was to summon all the Captains as often as Weather, &c. will permit, and in this Meeting that all the particular Ships Journals were produced and compared; in order therefrom, to form a Fleets Journal, in the same manner as before.

Suppose again, that these Ships and Fleets Journals, and all other Accounts relating to this Subject that should come to Hand by this, or any other more convenient and practicable Method that may be hit upon, were examined at proper Periods, by Persons appointed for that purpose; might not more Accurate Charts be made from them, than any Extant? might not the Variation, Currents, &c. be so far accounted for in most parts of the World, as to render the Business of Navigation much less uncertain and hazardous than at present; and would not such a Knowledge of the Variation as has been observ'd before, even practically determine the Longitude at Sea?

Of

Of this material Truth, the eminent and ingenious Mr. *Edward Wright*, (Inventor of the *Chart*, commonly, tho' falsely, called *Mercator's*) was well apprized, many Years ago, as may be seen in his Book, entitled, *Errors in Navigation detected and corrected*, Second Edition, and also in the Third, Printed Anno 1657, by *Joseph Moxon*; in the Appendix to which, called the *Harven-finding Art*, he expresses himself thus, viz. "The Variation of the Magnetical Needle, and the Latitude of the Place being known, the same Place may be found, although the Longitude be unknown, and that daily Experience plentifully teacheth, &c.

And again, "neither is this unworthy the marking which hath often happened, that he which should have sailed to the Isle of *St. Helena*, when he was come to the Latitude of the same Island, and saw not there the Island, and was also ignorant whether he were to the Eastward or Westward from the same, by conjectures sought that Place towards the East, which indeed lay from him towards the West, and so the further he sailed, the further always he went from that Island. Now I leave it to thy Consideration, if he (whosoever he were that was Master of that Ship, which diligently sought that Island for the Space of certain Weeks, tacking about also divers Times, before he could find any Place to abide in) if he, I say, had not been ignorant what the Variation of the Compass was at *St. Helena's* Island, and what the use of the Variation is at Sea, and how to find it out, I leave it I say, to thy Consideration, whether he would willingly have floated doubtfully to and fro following a greater Variation, knowing assuredly that the Variation there was lesser."

"If any Man likewise considers the uncertain Situation of those Places which are set into Globes or Sea-Charts, by the Mariners Relation, which uncertainty taketh his beginning from hence, because every Man thinketh *that* to be the true Place of the North, which is shewed by the *Flower de Luce*, (as they call it) of the Compass which they brought with them from Home, which Thing also bringeth no less doubtfulness to the Mariners themselves; he will think; (and that not without Cause) that the Variation is a very needful Thing, even for this Cause also.

These

“ These Things therefore have been observed and granted, and
 “ this especially, that the Variation altereth according to the
 “ variety of Countries, (as by the common Testimony of all Men
 “ it is proved) it is in some Sort manifest, that they which deny
 “ this varying Property to be of very great Use for Navigation,
 “ are either wiser than the common Sort, and have some hidden
 “ Secrets which are not revealed to every Man, or else are notable
 “ Fools and Mad-men.

“ Therefore when the most excellent Prince *Maurice*, having
 “ thoroughly considered hereof, thought that it might assuredly be
 “ brought to that pass, that Mariners might receive great Profit
 “ by this Means, he (the high Admiral) gave Commandment
 “ to all the Companies of the Admiralty (adjoining also thereto
 “ a certain Introduction) that they should do their best endeavour
 “ that all Masters of Ships should provide themselves for that
 “ purpose; that is to say, that to what Place soever they should
 “ come, they should seek out the Declination of the Magnetic
 “ Needle from the North, or the Variation of the Compass, not
 “ lightly running over the Matter as it were by the way, and for
 “ fashion-sake only; but with great Carefulness and Diligence,
 “ taking with them meet and needful Instruments for that purpose;
 “ and that after their return into their own Country, they
 “ should truly and faithfully Certify to their Companies or
 “ Brotherhoods of the Admiralty of that Matter, that the self
 “ same Experiments being by them brought into good Order,
 “ might be published for the common good.”

As a Specimen for this useful purpose, Mr. *Wright* has exhibited
 in his said Book, sundry Tables of the Variation, as observed by
 himself, *Petrus Plancius* and others; for which *vide* pages 72, 73
 in the 1st Part, pages 93, &c. in the 2d Part, and pages 6 and
 7 in the Appendix.

As this Book has been many Years out of Print, and consequently
 but in few Hands, the following Observations of the
 Variation extracted from the said Tables, and a few others, may
 not be unacceptable to the curious Navigator.

Near

	Variation		
Near London at Limehouse	11 d. 00 m.	} East	
	11 30		
About Portland	10 00	East	
At Scilly	10 00	East	
From Cape Lizard S. by W. 8 Leagues	12 50	East	
At Youghall in Ireland	10 00	East	
At Fayall, on a medium	03 05	East	
Hard by Flores, or betwixt it and Fayall	00 00		
From Flores Eastward 70 or 80 Leagues	00 00		
Crossing the Meridian of Flores and Corvo	01 00	West	
At Cape Finister	08 30	East	
At the Canaries	05 37	East	
Riding at Anchor near Cape Blanco	03 00	East	
At Cape Verde	07 00	East	
At the Island of Trinidad	00 00		
In the Meridian of Barbadoes, in Latitude 14 d. 20 m. North	} 00 00		
At Cape Florida	03 00	West	
At the Island of Ascension	10 00	West	
At St. Helena, on a medium	04 55	East	
At the Island of Tristram Acunba	19 00	East	
At the East Mouth, or Entrance into Magel- lans Straits	} 05 30	East	
About Cape Rona Esperance, in Latitude 35	02 00	East	
In the Isle of Mozambique	12 00	East	
At the Maldivie Islands	17 00	East	
At Zeylon	15 30	East	
At Bantam in Java, on a Medium	04 45	East	
In the Isle of Waigatz	07 00	West	
At North Cape	01 00	West	
At Antwerp in Brabant	09 00	East	

From a scarce Book, Entitled the *New Attractive*; a Discourse of the declining or dipping Needle, first found by Robert Norman, Hydrographer, dedicated to William Brouncker, Comptroller of her Majesties Navie, printed by Thomas Kingston, Anno 1581; the following Observations were communicated by John Hyde, Esq; viz. In Page 15 he says, North Pole dips under the Horizon 71 d. 50 m.

Annex'd

Annex is upon the Variation of the Compass by *W. B.* in 3d Chapter he shews the Variation at *Limbeuse*, the 16 October, 1580. in Latitude 51d. 32m. North, was one Point Easterly.— 11 Chap. at *Antwerp* it was 9d. East. — By Mercator 12 Chap. at *Ratisben*, in Latitude 48d. 52m. North, was 11d. 45m. East.— By Gerard Mercator at *Waygatz* in Latitude 70d. 00m. North, was 7d. West.— The Variations here for *London*, *Antwerp*, and *Waygatz*, are the same as in *Wright's* Tables; it is therefore more than probable that he took them from *Borowb's*, as *Wright's* first Edition was not publish'd until the Year 1599; and what adds to this Probability, may be gathered from the same in Page 72, containing Observations made by himself.

“ These Observations (says he) made in the Town of *Fayall*,
 “ and the former also at *St. Cruz* in *Flores*, were taken by Mr.
 “ *William Borow's* Instrument of Variation (published in his
 “ Book of the Variation of the Compass) and by a Quadrant
 “ whose Semidiameter was almost three Foot. ” In Page 84 he makes the Inclination or Dip of the Magnetic Needle in the Latitude of *London* 51d. 32m. North, to be about 73d. by Calculation.

The following are Dr. *Bradley's* Observations made at the Royal Observatory at *Greenwich*.

	Variation West.	Dip.
1749 Jan. 7 ———	17d. 22½m. ———	73d. 30m.
1750 June 24 ———	17 25 ———	73 30
1752 Aug. 28 ———	17 55 + ———	73 25 —
1754 June 25 ———	18 03 ———	73 25 —
1756 Nov. 16 ———	18 33 ———	73 25 —
1757 Aug. 5 ———	18 30 to 35 ———	73 15 to 25

Hence, by comparing the foregoing Ancient Observations with those of Dr. *Bradley's*, and the present Chart, for the same Places, may not only be discovered what small Alteration is made in the Inclination or Dip, during the space of about 170 Years last past; but also the very considerable and surprizing Mutation of the Variation, both in Quantity and Quality.

F I N I S.



